1. prophase**;**
centromere**;** **A** *kinetochore*
R *centrosome*
membrane / envelope**;**
chromosomes / centromeres**;** **A** *chromatids*
R *homologous chromosomes / bivalents*
anaphase**;**
poles / ends**;** **A** *centrioles / asters*
R *sides*
cytokinesis**;** **R** *telophase / cytokinin*
genetically**;**

[8]

2. (i) 46/23 pairs; 1

(ii) mitosis; **R** *any possible confusion with meiosis* 1

[2]

3. (a) *treat references to 'replication' or 'chromosome number' as neutral*

makes cells / cell division**;** **A** nuclei
genetically identical / clone**;**
growth**;** **R** 'of cell'
repair (of tissues)**;** **R** 'of cell'
asexual reproduction**;** max 3

(b) (i) *treat 'growth' and 'cytokinesis' as neutral*

sreplication of DNA**;**
centrioles replicate**;**
production of (named) organelles**;**
protein synthesis**;** **A** named e.g.
RNA / nucleotide **,** synthesis**;**
respiration / active transport / named e.g. of usual cellular activity**;**
AVP**;** e.g. semi-conservative
chromosome = 2 chromatids max 3

(ii) clockwise arrow head drawn**;** 1

(c) *ignore refs. to late or early stage - except in (i)*
any ref. to I or II = 0
invalid choice = 0

(i) (early) anaphase**;** **A** (late) metaphase 1

(ii) prophase**;** 1

(iii) telophase**;** 1

(iv) anaphase**;** 1

(v) metaphase**;** 1

[12]

4. *ignore refs to early and late stages*
NOT *ref to I and II* 1

(i) telophase**;**

(ii) metaphase**;** 1

(iii) prophase**;** 1

(iv) anaphase**;** 1

(v) anaphase**;** 1

[5]

5. (a) **R** *"I" and "II" throughout*

(i) prophase; 1

(ii) interphase / S phase; 1

(iii) telophase; *ignore cytokinesis* 1

(b) **1** attach to spindle;

2 by centromere;

3 centromere, divides / splits; **R** breaks

4 spindle fibres shorten / AW;

5 chromosomes / chromatids, pulled to, poles / centrioles / different ends of cell / different ends of spindle;
nucleus / 1 of each pair

6 centromere leading;

7 detachment from spindle fibres;

8 (start to) unravel / uncoil / decondense / lengthen / AW; 4 max

[7]

6. *only award marking points 1, 6, 9, 14 and 16 if descriptions of the stages are correct- do not award simply for identifying the stages – ignore ref to centrioles*

prophase

1 C**;**
2 chromosomes / chromatids **,** condense / coil / shorten and thicken**;**
3 become visible**;**
4 consist of two chromatids**;**
5 joined by a centromere**; A** kinetochore **NOT** centrosome

metaphase

6 A**;**
7 chromosomes align at **,** equator / metaphase plate**;**
8 attached to spindle by centromeres**;**

anaphase

9 B**;**
10 centromere splits**;**
11 chromatids separate**;**
12 move to opposite poles**;**
13 by **,** contraction / shortening **,** of spindle**;**

telophase

14 E**;**
15 chromosomes uncoil**;**

interphase

16 D**; A** for a description of early prophase
17 DNA replication**;**
18 transcription / formation of mRNA**;**
19 AVP**;** *these must relate to behaviour of chromosomes*
20 AVP**;** e.g. spindle made of microtubules
chromatin becomes chromosomes (in prophase) ora in interphase
centromere leads chromatid to pole
gene switching during interphase 9 max

QWC – clear well organised using specialist terms; 1

award the QWC mark if three of the following are used in correct context, but Q = 0 if names or names of stages of mitosis are used inappropriately

chromatin	equator / metaphase plate
chromatid	DNA replication
centromere	transcription
spindle	

[10]

7. (a) *look for shading in* ***A***
do not credit if more than 1 chromosome shaded

corresponding homologous chromosome correctly shaded on **A;**
i.e. bottom one 1

(b) *mark (i) and (ii) independently*

(i) metaphase**; R** ref to metaphase I or II 1

(ii) (individual) chromosomes align at **,**
metaphase plate / equator / centre (of cell)**;**
join to **,** spindle / microtubules**;**
by centromeres**;**

ref to bivalents / homologous pairs = max 1 2 max

(c) **C;**
A; 2

[6]

8. flagellum for movement**;**
chromosomes / DNA, in haploid nucleus / AW, for fertilising egg cell**;**
head / cap / acrosome, shaped for penetrating egg cell (membrane)**;**
(many) mitochondria for energy / ATP, for movement**;** max 3

[3]

9. (a) (i) *Each of the following to be labelled with a clear label line.*

Allow ***P*** *and* ***E*** *as letters inside the appropriate cell.*

P / palisade mesophyll cell;
E / lower epidermal cell**;**
C / cuticle; 3

(ii) *award two marks if correct answer (150) is given*
incorrect answer (or no answer) but correct working = 1 mark

(×) 150;**; R** units

A in the range 147 – 153 ***answer should not exceed 1 d.p.***

if answer incorrect or to too many d.p., then allow 1 working mark for ÷ 0.7 (mm) or equivalent 2

(b) *if describing organ, max 1*

made up of, more than one / two / a few, types of cell; **A** named cell types (vessel / fibre / parenchyma) working together / AW;
with a, specific / particular / same, function / role / purpose / job;
A named function
A transport minerals
R transport nutrients 2 max

[7]

10. (a) **C**;
E; 2

(b) large surface area (to volume) / many**;**
low water potential**; A** ref to low solute potential
R refs to water concentration
A refs to (high) solute concentration
thin wall / short diffusion path**;**
uncutinised / permeable / unlignified / AW**;**
rapid, growth / replacement**;** 2 max

(c) **1** osmosis in correct context**;**
look for across membrane, or, into / out of, cell / root

2 moves down a water potential gradient / from high to low water potential**;**
R along / across **R** concentration / diffusion gradients

3 most negative / lowest, in the xylem**;**

4 (uptake of) ions / minerals / solutes, into xylem / root hair**;**
in context of WP gradient

5 tension in xylem / transpiration pull / cohesion-tension**;**
relate to pathway in root

6 (moves) via the cell walls**;**

7 (moves) via, cytoplasm / vacuoles**;**

8 passage via the plasmodesmata**;** *look for linking cytoplasm / through wall*

9 Casparian strip / suberin / waxy / fatty / AW, blocks, cell wall route / apoplast**; A** waterproof

10 water, crosses membrane / enters, cytoplasm / vacuole / symplast**;**

11 AVP**;** e.g. pits in xylem / passage cells /aquaporins / protein channels / capillarity in cell wall (spaces) max 6

credit points from diagram

QWC – legible text with accurate spelling, punctuation and grammar; 1

(d) *1 for feature and 1 for role in each section* ***except lignin*** *but max 2 for features and max 2 for functions*
apply AW throughout

lignin / AW;
(allows) adhesion / waterproof / stops collapse (under tension);
A two functions

rings / spirals / thickening / AW**;** **A** thick wall / rigid sides
prevents collapse (under tension); **R** strong / support / stops bursting

no cytoplasm / lack of contents / hollow / (empty) lumen / AW**;**
R "dead" unqualified
less resistance to flow / ease of flow / AW / more space (linked to lack of contents)**;**

lack of end walls / continuous tube**;** **A** long tube idea
less resistance to flow / ease of flow**;** **A** continuous columns idea

pits / pores, inside walls**;** **A** holes **R** gaps
lateral movement / get round air bubbles / supplies(water) to cells or tissues / water in or out; **R** "just let things in and out" unqualified

develop as a continuous water-filled column / AW**;**
allows tension to pull water up / AW**;**

narrow lumen / AW**;**
idea of more capillary rise**;** 4

[15]

11. (i) nucleus / nuclear envelope / nuclear membrane**;** 1

(ii) (made up of) one type of / (squamous) epithelium**,** cell(s)**;** **A** *same* **R** *similar alone*
(group of) cells performing the same function(s)**;** **A** *task / job* 1 max

(iii) large surface area**;**
permeable**;**
thin / short, diffusion path**;**
moist**;**
good blood supply / close to blood**;**
well ventilated / in contact with respiratory medium**;** 2 max

[4]

12. (i) group of cells**;**
of one or more types**;** **A** *'common origin'*
with intercellular material/connective tissue / AW**;**
(specialised) to perform particular function(s)**;** **R** *job* max 2

(ii) *1 mark for any suitable named tissue e.g.*
xylem / phloem / epidermis / mesophyll / palisade / spongy mesophyll / chlorenchyma / etc./ meristem / cambium / suitable named tissue**;**

R leaf tissue / root tip / vascular tissue alone / xylem vessels / sieve tubes 1

[3]

13. organ(s); **[1]**